## Unit Plan : Trigonometric Equations and Identities

<table>
<thead>
<tr>
<th>Teacher: Ms. Nordstrom</th>
<th>School: St. Stephen High School</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject: Trigonometry and 3-Space</td>
<td>Grade Level: 122</td>
</tr>
<tr>
<td>Content/Theme: Trig Equations and Identities</td>
<td></td>
</tr>
<tr>
<td>From: November 4&lt;sup&gt;th&lt;/sup&gt;</td>
<td>To: December 8&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

### Daily Outline:

**Day 1: October 27<sup>th</sup>**
- ½ Class Pre-test on adding/subtracting/multiplying/dividing fractions and radicals, as well as solving algebraic expressions.

**Day 2: November 4<sup>th</sup>**
- Review adding/subtracting/multiplying/dividing fractions and radicals
- Add and subtract algebraic expressions with monomial denominators
- Practice

**Day 3: November 5<sup>th</sup>**
- Answers to practice from day 2 given, students self assess quickly
- Add and subtract algebraic expressions with polynomial denominators
- Multiply and divide algebraic expressions with denominators
- Practice

**Day 4: November 6<sup>th</sup>**
- Groups of 4, set up stations to practice each skill learned on days 2 and 3.
- Worksheets handed in at end of class

**Day 5: November 7<sup>th</sup>**
- Unit circle: co-terminal angles, principle angles, partners of angles
- Review SOHCAHTOA. Use it to determine that cos = x, sin = y, and tan = sin/cos
- 3-2-1 Exit Slip
Day 6: November 12th
- Investigation 1 on page 130 in MM2. Determine co-ordinates associated with the rotation of various points on the unit circle.
- Use co-ordinates to fill in the trig table for the special angles, their partners, and axes
- Investigate answers of problems like \( \cos (-180°) \) or \( \sin 540° \)
- 3-2-1 Exit Slip

Day 7: November 13th
- Consult the trig table to investigate the values for partnered angles. Consider whether they are positive and negative, and use them to determine CAST relationship.
- MM2 page 130, 131 q’s 1-4 – individual work

Day 8: November 14th
- Use trig table to solve trigonometric equations with and without calculators (use calculators to double check results)
- Practice using patterns in the trig table (partners of angles, etc) to solve simple trig expressions without calculators or a full trig table.
- MM2 page 136 -138. Selections from q 13, 14, 15, 18, 19

Day 9: November 17th
- Quiz on using patterns to fill in a shortened trig table and solve basic trig functions.
- Trigonometric Bingo game

Day 10: November 18th
- Plot rotation of points on a unit circle as a sin graph
- Solve functions algebraically and by extrapolation

Day 11: November 19th
- Examine context based problems to determine whether they are sinusoidal functions
- Generate scatter plots to describe periodic systems.

Day 12: November 24th
- Practice with material from days 6-8 (work sheet)
- Intro to identities and reciprocal functions: they already know \( \tan = \frac{\sin}{\cos} \), introduce sec,
csc, and cot.
- 3-2-1 Exit Slip

Day 13: November 25th
- Derive remaining basic trigonometric identities
- Practice proving basic identities. Develop work sheet, or use questions from MM2 page 155 – 156

Day 14: November 26th
- Practice proving identities – continue worksheet. Peer assessment when complete.
- Choice assignment is given, due by Day 20

Day 15: November 27th
- Investigate arc length and its relation to unit circle. Use page 100 and 101 of curriculum document for table.

Day 16: November 28th
- Investigate what happens to arc length and co-ordinates of points on unit circle as radius of unit circle increases.

Day 17: December 1st
- Pre-Test for upcoming unit.
- Practice material from day 15 and 16. Use pages 161 – 164 of MM2.

Day 18: December 2nd
- Practice solving trigonometric equations given in radian measure.
- Describe transformations in sin and cos graphs using radian measure.

Day 19: December 3rd
- Work period for choices assignment
- Possible enrichment: Use regression analysis to determine equations of sinusoidal functions.

Day 20: December 4th
Review for test

Day 21: December 5th
Unit Test

Day 22: December 8th

- Flex day. If not needed, can be used to review test with class.

**Objectives:**

Students will learn to:

1. solve trigonometric equations algebraically or by interpreting graphs of related sinusoidal functions.
2. prove various trigonometric identities, and simplify expressions using trigonometric identities.
3. work with radian measure.

**Curricular Outcomes:**

A1 demonstrate an understanding of irrational numbers in applications

B1 demonstrate an understanding of the relationship between operations on fractions and rational algebraic expressions

B4 use the calculator correctly and efficiently

C1 model situations with sinusoidal functions

C2 create and analyse scatter plots of periodic data

C3 determine the equations of sinusoidal functions

C9 analyse tables and graphs of various sine and cosine functions to find patterns, identify characteristics, and determine equations

C15 demonstrate an understanding of sine and cosine ratios and functions for non-acute angles

C18 interpolate and extrapolate to solve problems

C21 describe how various changes in parameters of sinusoidal equations affect their graphs

C24 derive and apply the reciprocal and Pythagorean identities

C25 prove trigonometric identities

C27 apply function notation to trigonometric equations

C28 analyse and solve trigonometric equations with and without technology

C30 demonstrate an understanding of the relationship between solving algebraic and trigonometric equations
derive, analyse, and apply angle and arc length relationships

demonstrate an understanding of the connection between degree and radian measure and apply them

**Possible Enrichments:**

*C17*(121) solve problems by determining the equation of the curve of best fit using sinusoidal regression

*F6*(121) explore periodic data to determine the equations of sinusoidal curves using regression analysis

**Skills:**

Students will be able to:

1. interpret sine and cosine graphs, and use interpretations to solve trigonometric equations.

2. construct sine graphs from the rotation of a point on the unit circle.

3. solve trigonometric equations algebraically.

4. prove trigonometric identities.

5. understand the relationship between radian measure and degree measure, and work with both.

<table>
<thead>
<tr>
<th>Products/Assessment Methods:</th>
<th>Processes/Teaching Strategies:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>Lecture**</td>
</tr>
<tr>
<td>Quiz</td>
<td>Demonstration**</td>
</tr>
<tr>
<td>Test</td>
<td>Guest Speaker</td>
</tr>
<tr>
<td>3-2-1 Exit Slips (random placement throughout unit)</td>
<td>Co-operative Learning**</td>
</tr>
<tr>
<td>Practice Questions and Worksheets (incorporates self-evaluation, peer evaluation, teacher evaluation)</td>
<td>Discussion**</td>
</tr>
<tr>
<td>Group work assessment (station activity)</td>
<td>Debate</td>
</tr>
<tr>
<td>Choice homework assignment</td>
<td>Learning/Interest Centers**</td>
</tr>
<tr>
<td>Peer and self evaluations (informal)</td>
<td>Independent Study**</td>
</tr>
<tr>
<td></td>
<td>Small Group Study**</td>
</tr>
<tr>
<td></td>
<td>Peer Tutoring**</td>
</tr>
<tr>
<td></td>
<td>Role Play</td>
</tr>
<tr>
<td></td>
<td>Field Trip</td>
</tr>
<tr>
<td></td>
<td>Note Taking**</td>
</tr>
<tr>
<td></td>
<td>Experiment**</td>
</tr>
<tr>
<td></td>
<td>Learning Games**</td>
</tr>
</tbody>
</table>

Processes/Teaching Strategies:

Lecture**

Demonstration**

Guest Speaker

Co-operative Learning**

Discussion**

Debate

Learning/Interest Centers**

Independent Study**

Small Group Study**

Peer Tutoring**

Role Play

Field Trip

Note Taking**

Experiment**

Learning Games**
Multiple Intelligences:

Linguistic: Through word problems and through choice homework assignment

Logical-Mathematical: Through activities and logical mathematical questions and concepts

Bodily-Kinesthetic: By investigation one with water wheel, and choice homework assignment

Spatial: Through pictorial and graphical activities

Interpersonal: Through group work and practice in pairs

Intrapersonal: Through individual work

Musical: Through choice homework assignment

Learning Styles:

Visual: Through pictures, graphs, charts, etc incorporated into class work and notes

Auditory: Through lectures, group discussion and occasional whole class discussion, as well as trig bingo game

Kinesthetic: Through use of group activities requiring movement about room, and through investigation 1 with water wheel

Bloom's Taxonomy:

Knowledge: define principle, co-terminal and partners of angles

Comprehension: distinguish sine and cosine characteristics as applied to a unit circle, distinguish radian measure from degree measure

Application: solve trigonometric equations, in degree and radian measure

Analysis: determine whether various expressions are trigonometric identities

Synthesis: generate graphs of sine functions from various data sets

Evaluation: evaluate whether various real-life situations display sinusoidal characteristics

Resources & Materials Required:

Blackline masters, MM2, activity sheet handouts, tasks for station activity, water wheel manip, Autograph software, choice homework options sheet, quizzes, tests, overhead projector, overhead solutions and activities, smartboard and in-focus set-up, trig bingo cards and caller cards, graphing calculators (maybe, for enhancement activities)

Math department teachers (contact information), district math mentor (contact information), district technology mentor (contact information).
**Instructional Differentiation:**

The choice homework assignment will provide options that appeal to various students.

For struggling students, generate resources with slower introduction and easier practice questions to allow them to move at their own pace.

For students who are excelling, there are possible enhancement opportunities that they can be given involving regression analysis.